Ohm’s Law

The fundamental relationship among the three important electrical quantities *current*, *voltage*, and *resistance* was discovered by Georg Simon Ohm. The relationship and the unit of electrical resistance were both named for him to commemorate this contribution to physics. One statement of Ohm’s law is that the current through a resistor is proportional to the voltage across the resistor. In this experiment you will see if Ohm’s law is applicable to several different circuits using a Current Probe and a Voltage Probe.

Current and voltage can be difficult to understand, because they cannot be observed directly. To clarify these terms, some people make the comparison between electrical circuits and water flowing in pipes. Here is a chart of the three electrical units we will study in this experiment.

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| --- | --- | --- | --- |
| Electrical Quantity | Description | Unit | Water Analogy |
| Voltage or Potential Difference | A measure of the Energy difference per unit charge between two points in a circuit. | Volt (V) | Water Pressure |
| Current | A measure of the flow of charge in a circuit. | Ampere (A) | Amount of water flowing |
| Resistance | A measure of how difficult it is for current to flow in a circuit. | Ohm () | A measure of how difficult it is for water to flow through a pipe. |

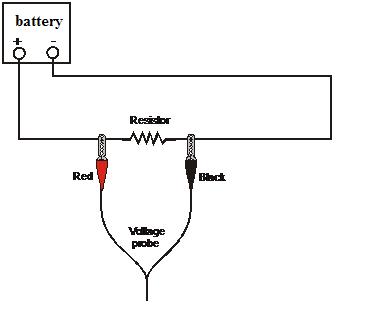


Figure 1

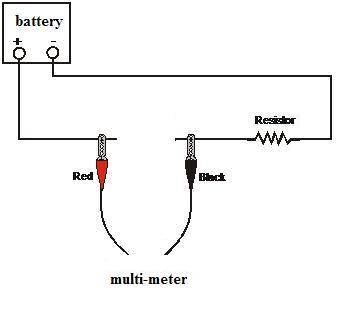
**PURPOSE:**

The purpose of this lab is to investigate the relationship between the three variables involved in Ohm's Law - Current, Voltage and Resistance.

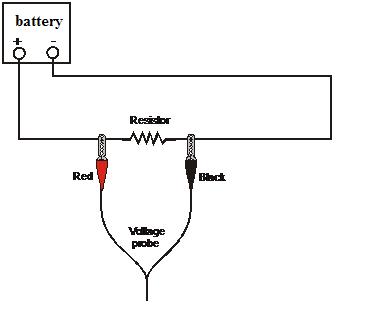
**MATERIALS:**

* D-Cell battery
* Wire
* Digital Multimeter (DMM)
* Resistors

**PROCEDURE:**



1. Choose one of the resistors that you have been given. Using the chart at the end of this lab decode the resistance value and record that value in the first column of the Data Table. Construct the circuit above, leaving the wire between the resistor and the battery unconnected. Have the instructor check your wiring before going on.
2. Set the DMM to the 20 MA range, noting that the red lead should be connected to the plug on the DMM designated for "MA" or "A". The black lead should always be connected to the "COMMON" plug. When your circuit has been approved, connect the remaining wire and read the current that is flowing through the resistor. Record this value in the second column of the Data Table. Note that the decimal point is for MA or milliamps - 0.001 amps.
3. Now replace the original resistor with the remaining resistors, one at a time, each time recording the resistance value and the current you measured.
4. When you have completed measuring all of the currents, disconnect the meter and connect the circuit shown below. Change the meter to the 2VDC scale (or 2000 mV) and move the red lead to the plug on the meter that indicates "V". Measure and record the voltage across the resistor for each of the resistors. (On the 2000 mV scale, the decimal point is for millivolts.)



1. When finished making measurements, turn the meter off, secure all of the resistors by placing at least one end of each in a spring, and disconnect the wire(s) from the battery. Process the data you've obtained. The results of this experiment are important and will definitely be covered on any quizes, etc.

**DATA TABLE:**

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| **Resistance ** | **Current A** | **Voltage V** | **Voltage/Resistance V/** |
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**ANALYSIS:**

1. For each of your sets of data, calculate the ratio of Voltage/Resistance. Compare the values you calculate with the measured values of the current.
2. Construct a graph of Current (vertical axis) vs Resistance.

**DISCUSSION:**

1. From your graph, what is the mathematical relationship between Current and Resistance (for a constant voltage)?
2. Ohm's Law states that current is equal to the ratio of voltage/resistance. Does your data concur with this? Explain.
3. What were possible sources of experimental error in this lab? Would you expect each to make your results larger or to make them smaller?